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AD 433801

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA



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U.S. Naval Air Development Center

Johnsville, Pennsylvania

AERONAUTICAL PHOTOGRAPHIC
EXPERIMENTAL LABORATORY

REPORT NO. NADC-AP-6312 31 DEC 1963

TEST AND EVALUATION OF TA-7M CAMERA
MANUFACTURED BY AEROJET DELFT CORPORATION

PHASE REPORT

WEPTASK FFRD00001/202 2/F001 04 02
Amendment No. 16

433801



Limitations concerning the distribution of
this report and revelation of its contents
appear on the inside of this cover.

DDC
MAR 31 1964

U. S. NAVAL AIR DEVELOPMENT CENTER
JOHNSVILLE, PENNSYLVANIA

AP-3
8653
31 Dec 1963

From: Commanding Officer, U.S. Naval Air Development Center,
Johnsville, Pennsylvania
To: Chief, Bureau of Naval Weapons

Subj: Report No. NADC-AP-6312, "Test and Evaluation of TA-7M
Camera Manufactured by Aerojet Delft Corporation,"
(Phase Report, WEPTASK No. FFRD00001/202 2/F001 04 02,
Amendment No. 16).

Ref: (a) BuAer Aer-PH-41/92 of 25 May 1956
(b) WEPTASK Assignment FPPH-411/219:MAT of 17 Aug 1960
Applied Research and Investigation of Components,
Equipment and Systems of 70mm Aerial Photography
to determine performance criteria for Reconnaissance
Purposes.

Encl: (1) Photographs of the TA-7M Camera
(2) Photographs of the TA-7M Camera Installed in RF-8A
(F8U-1P) Aircraft.
(3) Oblique Photography - Speed - 450 Kts., Altitude -
65 Ft.
(4) Oblique Photography - Speed - 450 Kts., Altitude -
500 Ft.
(5) Oblique Photography - Speed - 450 Kts., Altitude -
125 Ft.
(6) Vertical Photography - Speed - 450 Kts., Altitude -
65 Ft.
(7) Vertical Photography - Speed - 450 Kts., Altitude -
200 Ft.
(8) Vertical Photography - Speed - 535 Kts., Altitude -
140 Ft.
(9) Vertical Photography - Speed - 550 Kts., Altitude -
600 Ft.
(10) Vertical Photography - Speed - 640 Kts., Altitude -
100 Ft.

1. Reference (a) established TED project ADC PH-4578 which was reviewed and reissued by reference (b) as Amendment No. 16 to conduct research and investigation of components and systems of 70mm aerial photography. By this authority the TA-7M camera, manufactured by the Olde Delft Company, Netherlands, and distributed by the Aerojet Delft Corporation, was evaluated.

Subj: Report No. NADC-AP-6312, "Test and Evaluation of TA-7M Camera Manufactured by Aerojet Delft Corporation," (Phase Report, WEPTASK No. FFRD00001/202 2/F001 04 02, Amendment No. 16).

2. The TA-7M camera was specifically designed for low altitude high speed reconnaissance. Description of the camera is as follows:

Lenses

Lens Type (Deltamar)	52/2.7	70/1.7	100/1.1	150/1.5	300/2.8
Focal Length Inches (app)	2"	3"	4"	6"	12"
Relative Aperture	f/2.7	f/1.7	f/1.1	f/1.5	f/2.8
Field of View	57°	42°	32°	22°	11°
Stated Resolution lines/mm	60	50	40	40	40

Shutter Data

Shutter Type: Delft Microsecond double rotary disc focal plane shutter.

Shutter Speeds: Continuously variable from 1/900 to 1/9000 second.

Film and Cycling Rates

Film size and capacity: 70mm by 100 ft. standard aerial film perforations

Frame size: 2¼" x 2¼" (57mm by 57mm)

Frame spacing: 14 perforations

Cycling rates: 1 to 15 frames per second with continuous film transport, permitting zone control from V/H computer; presettings for 10% and 60% overlap.

Exposure Control: Integrated average reflection meter built into camera provides automatic exposure control.

Data Recording: Latitude, longitude and frame number with written data of camera position and flight mission are recorded between frames.

Filter: Removable minus blue filter.

Camera Control: Remotely from cockpit.

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Power Required: 28V D.C., 70 watts - 115V A.C., 400 cs, 5 watts

Camera Weight: 18 lbs with film and 3" lens.

Dimensions: 7½" by 8" by 9" (with 3" lens).

3. The TA-7M Delft camera was delivered to the Aeronautical Photographic Experimental Laboratory (APEL), on 16 May 1963 by a technical representative from the Delft Company. The camera was installed in an RF-9J (F9F-8P) aircraft for one phase of the testing and an RF-8A (F8U-1P) for another phase of the testing. Enclosure (1) illustrates the oblique installation in the RF-9J aircraft. Enclosure (2) shows the vertical installation in the RF-8A aircraft. A total of six flight tests were made, four of which were in the RF-8A (F8U-1P) aircraft and two in the RF-9J (F9F-8P) aircraft. All four flights in the RF-8A (F8U-1P) were made with the camera in the vertical position; two with the 52mm f/2.7 lens and two with the 70mm f/1.6 lens. Two flights were made in the RF-9J (F9F-8P), both with the 70mm lens, and installed at a 30° depression angle.

The flights were conducted at a range of altitudes and shutter speeds which would cover the full recycling capability range of the camera, which is from 1.5 to 15 frames/sec. The altitude was varied from 65 ft. to 600 ft. and the air speed from 350 to 600 knots. The shutter speed varied from 1/900 sec. to 1/9,000 sec.

4. The photography obtained with the TA-7M camera was very good for such low altitudes and high speeds, even at the maximum rate of 15 frames per second. The camera did not malfunction at any time. Although Tri-X film was recommended by the camera manufacturer, Plus-X film was used on one flight with the vertical installation and one flight with the 30° depression angle oblique installation. It was determined from these flights that the slower speed but higher resolution Plus-X film can be used under all sunlight conditions with superior results, enclosure (3). The shutter speed, cycling rate and forward motion compensation are mechanically interdependent and cannot be individually varied. The shutter speeds have a total range of 10 to 1 (1/900 to 1/9000) which corresponds to the recycling rate of 1.5 to 15 frames per second which is also a 10 to 1 ratio. The forward motion compensation settings, which are remotely controlled by the pilot for altitude and velocity on a V/H computer, determines the cycling rate and shutter speeds.

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The cycling rate is broken into six discreet steps by the V/H settings to 15, 9, 6, 4, 2.5 and 1.5 pictures per second and which corresponds to the 1/9000, 1/5400, 1/3600, 1/2400, 1/1500 and 1/900 second shutter speeds. This non-continuous or "zone" Image Motion Compensation (IMC) is considered adequate because of the high shutter speed capability which reduces the residual uncorrected forward image motion.

5. The TA-7M camera is specifically designed for very low altitude high speed reconnaissance as shown in enclosures (4) to (10) inclusive. At altitudes above 2,000 ft., this camera does not perform well because of excessive overlap, improper forward motion compensation at these altitudes and because the lenses are focused for a distance of approximately 150 ft. At altitudes of 500 ft. and lower, this camera performs very well. At altitudes of 50 ft. to 100 ft. at speeds of 500 knots or faster, it performs where other cameras lack the capability. This is because of its higher recycling rate of up to 15 frames per second in conjunction with its high (1/9000) shutter speeds in conjunction with the forward motion compensation.

6. It would be desirable to operate such a camera in conjunction with the existing camera control systems, rather than the Delft V/H manual computer. With the NCCS-4 system, the ground speed and altitude are determined by electronic sensors and fed into a computer which in turn feeds the proper pulses to the camera for control of the forward motion compensation and camera cycling rate. Inasmuch as the IMC and cycling rate in this camera is not continuously variable, but is limited to six discreet steps, it would require additional electronic equipment to make the TA-7M camera compatible with the NCCS-4 system.


7. It is concluded that the TA-7M camera is a very specialized camera for low altitude high speed operation only. As such, it has a superior capability, because of its high recycling rate and high shutter speeds, than any other similar reconnaissance camera. There were no malfunctions during the limited test program conducted on this camera in which there were only six flights. It could be predicted however, that this camera would have a high life expectancy, and require little maintenance. This is because of its simple design concept in which a constantly moving film mechanically tied to the simple rotating disc shutter eliminates the high stresses, at high recycling rates, imposed by the start and stop action of conventional cameras with between-the-lens or focal plane shutters.

AP-3

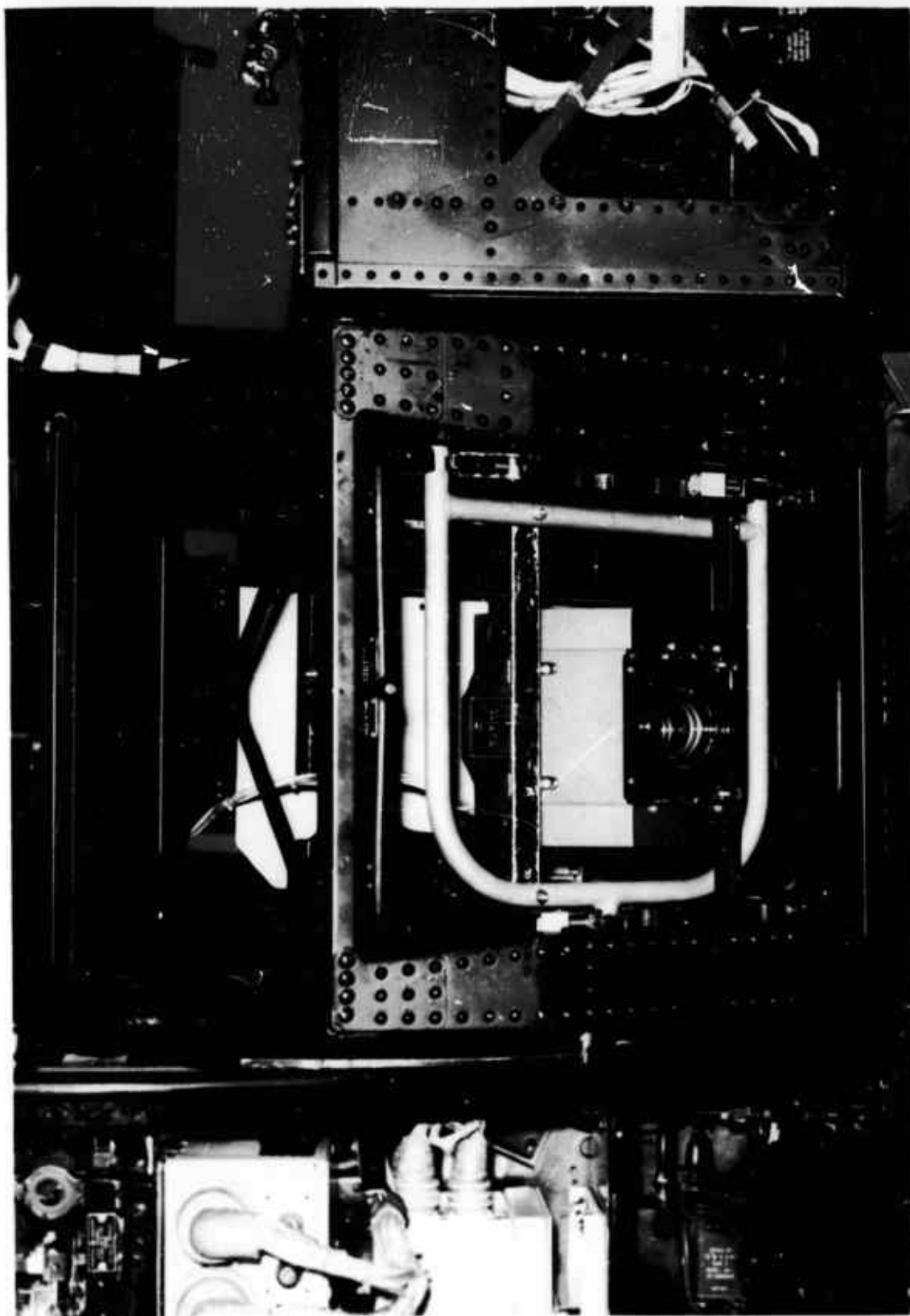
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(Phase Report, WEPTASK No. FFRD00001/202 2/F001 04 02,
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8. It is recommended that a limited quantity of the TA-7M be
procured where there is a specific requirement for extremely
low altitude, high speed missions.

9. With the issuance of this report work on this phase is
considered completed.


A.D. HEINZE
By direction

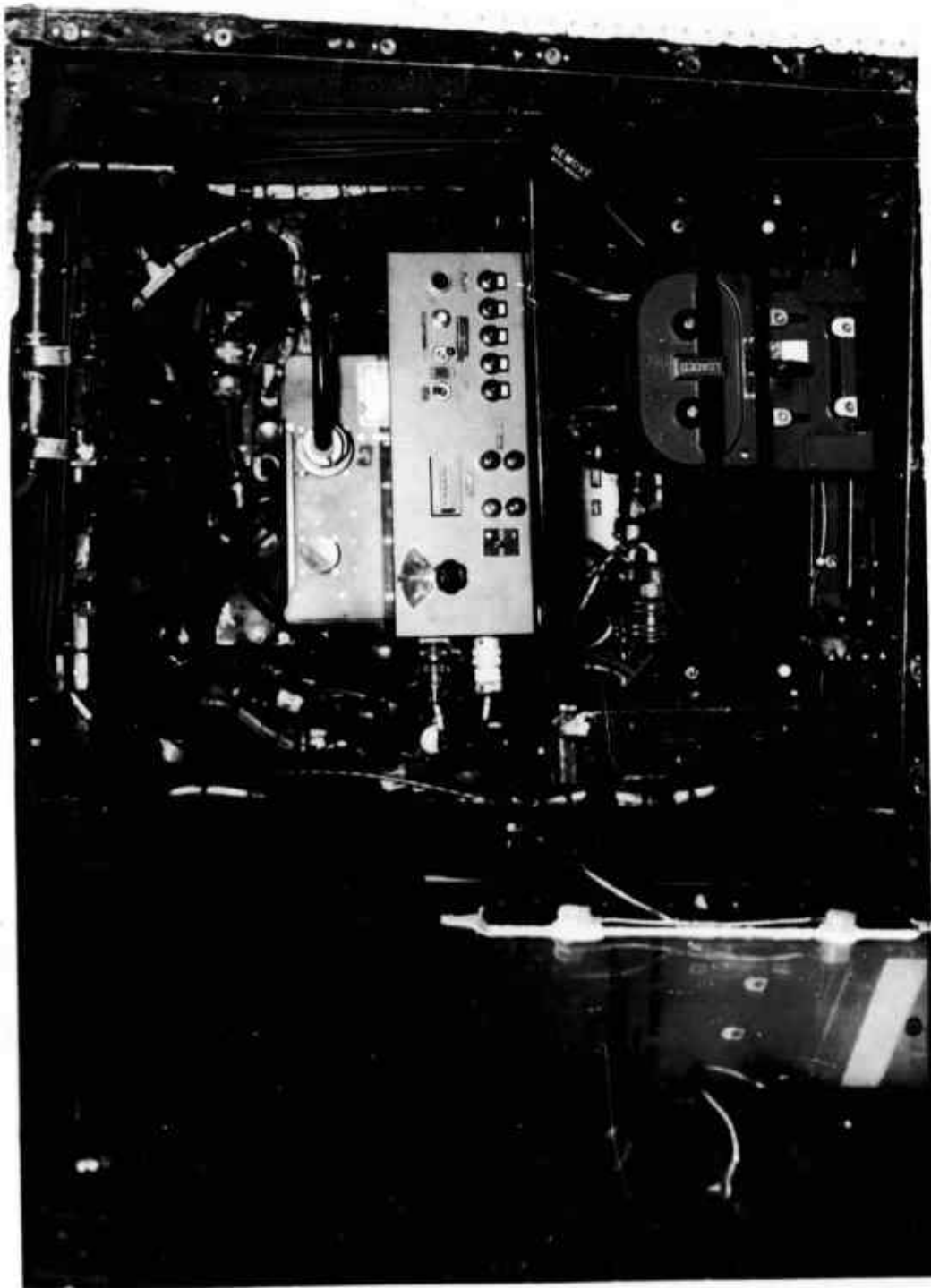
Encl distribution
(See back cover)



REPORT NO. NADC AP-6312

PHOTOGRAPH OF A TA-7 CAMERA SYSTEM INSTALLATION (LEFT SIDE)
IN AN RP-9J (F9F-8P) AIRCRAFT ROTATED FOR OBLIQUE PHOTOGRAPHY

ENCLOSURE (1)



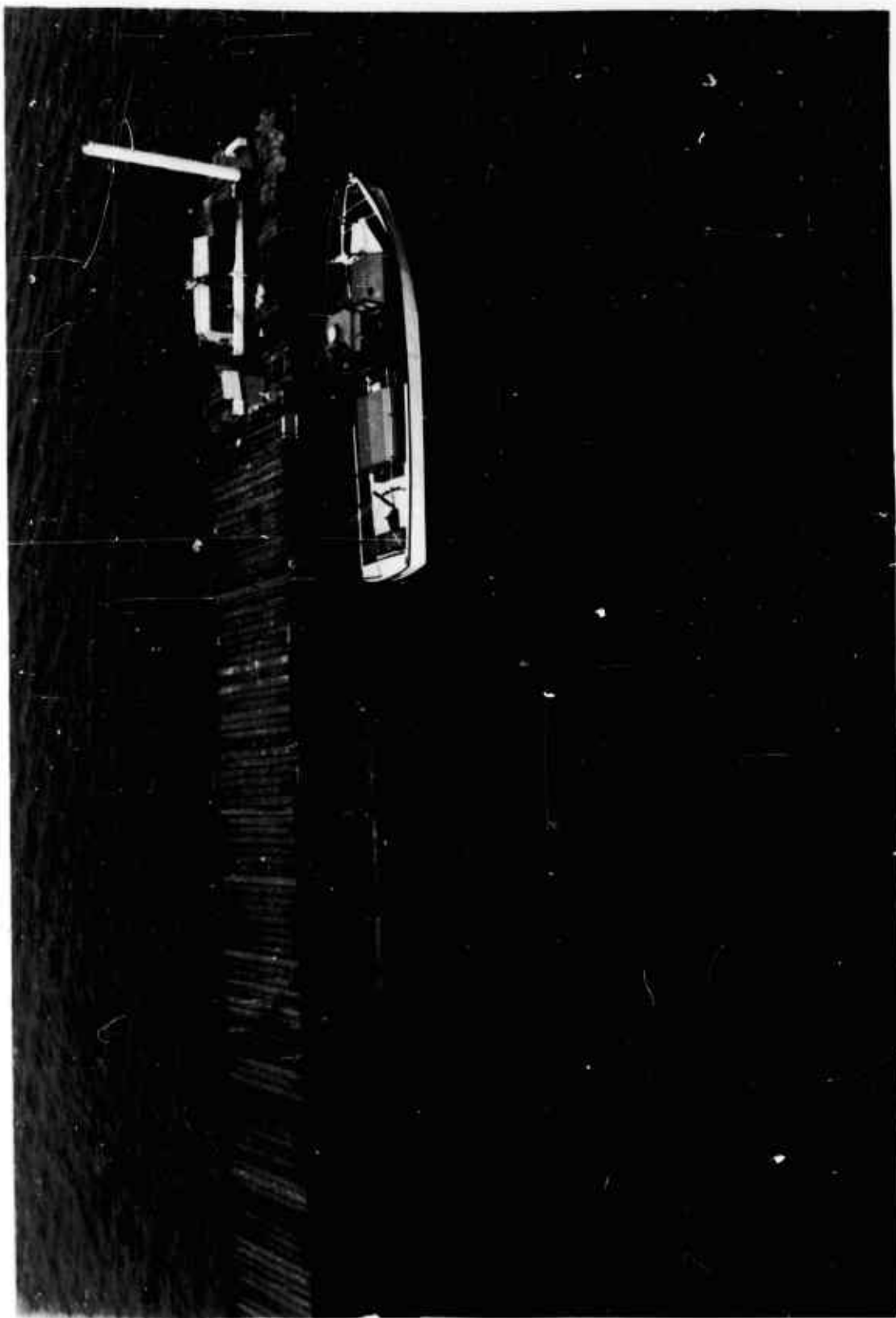
FUEL
CELL
ACCE

REMOVAL 10-7

REPORT NO. NADC AP-6312

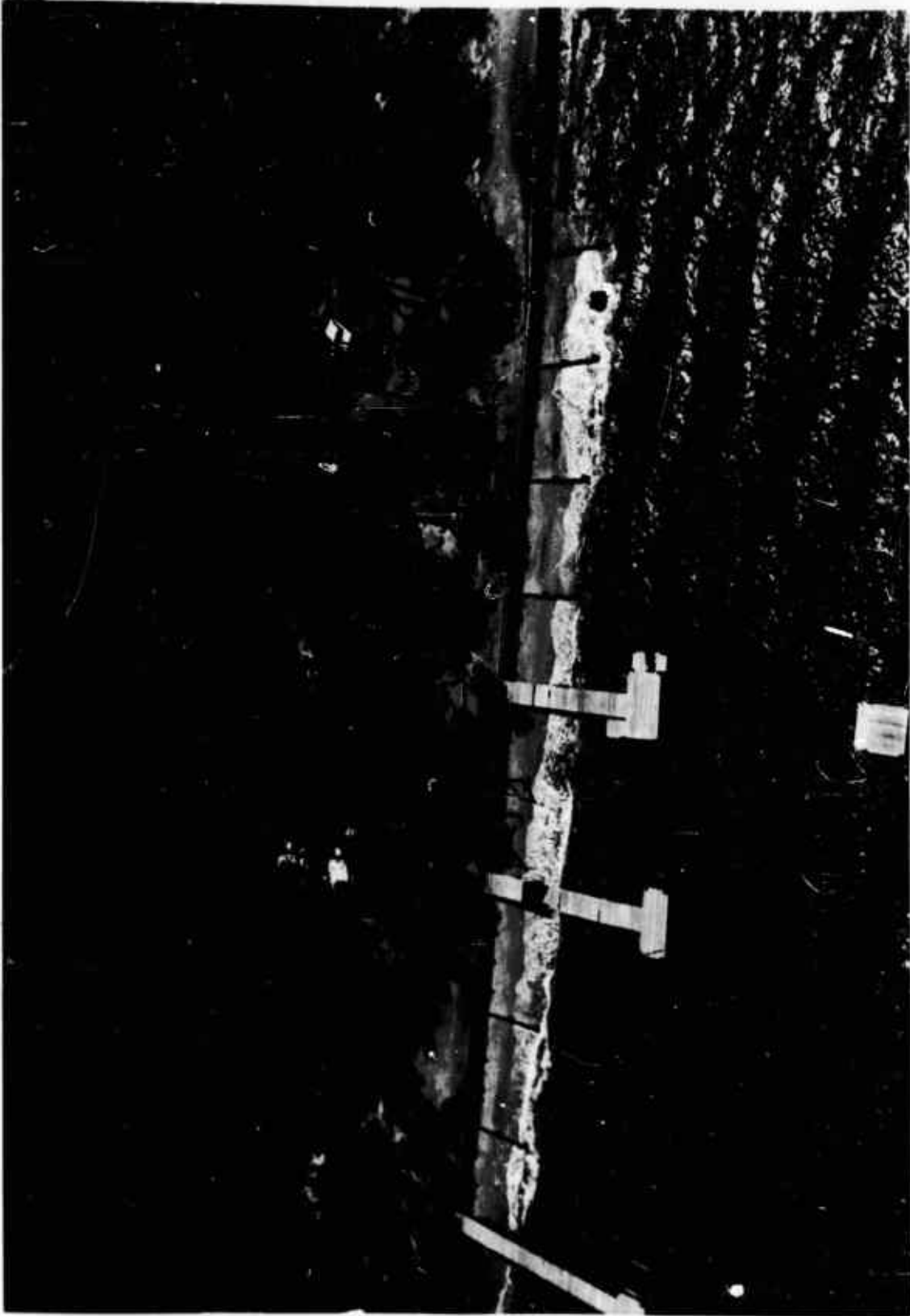
PHOTOGRAPH OF A TA-7 DELFT CAMERA SYSTEM INSTALLATION
IN THE RF-8A (F8U-1P) AIRCRAFT FOR VERTICAL PHOTOGRAPHY

ENCLOSURE (2)



REPORT NO. NADC AP-6312

OBLIQUE AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 450 KTS., ALTITUDE - 65 FT., CYCLING RATE - 9 FRAMES/SEC., SHUTTER SPEED - 1/5400 SEC.
ENCLOSURE (3)



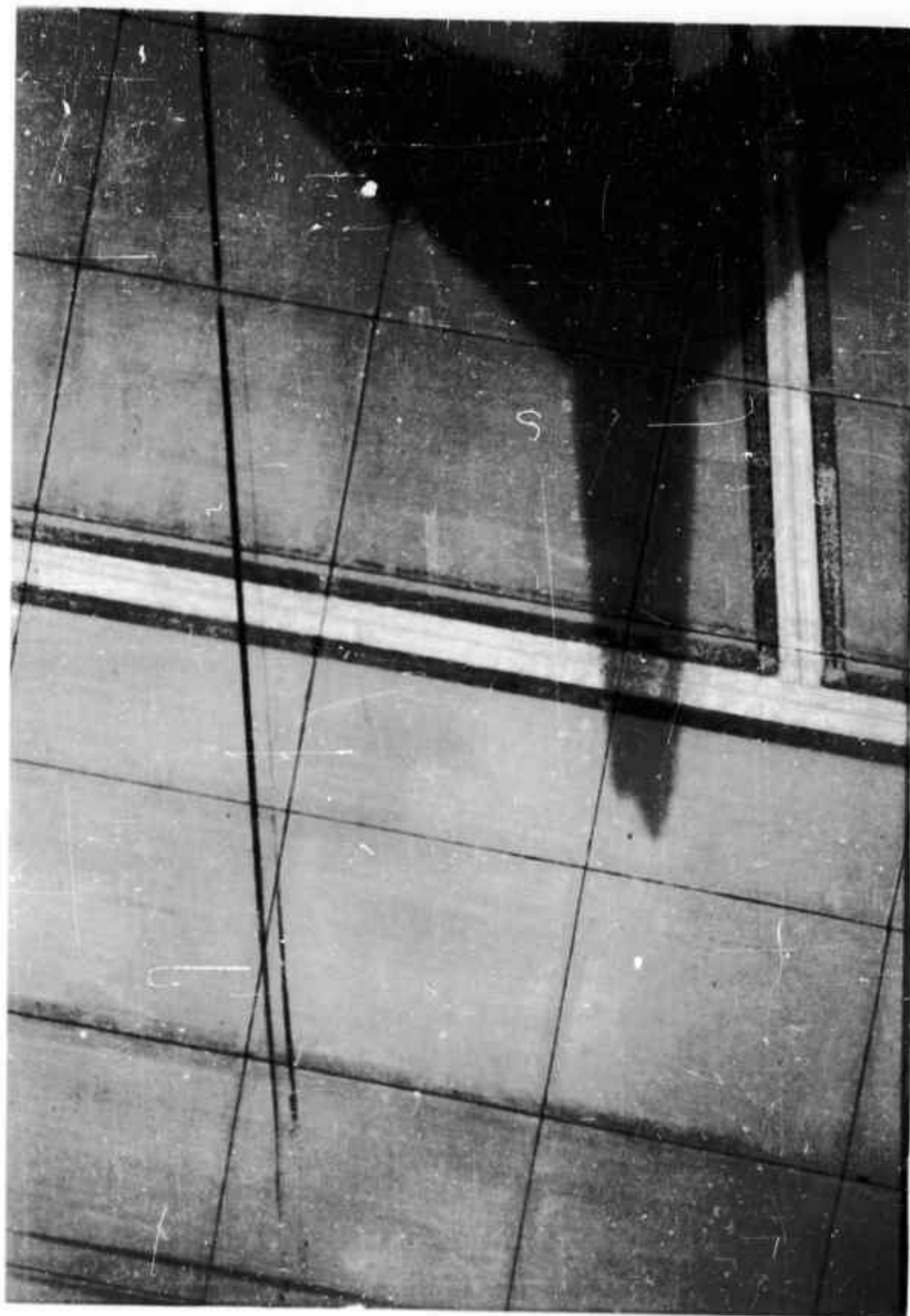
REPORT NO. NADC AP-6312

OBLIQUE AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 450 KTS., ALTITUDE - 500 FT., CYCLING RATE - 1.5 FRAMES/SEC., SHUTTER SPEED - 1/900 SEC.
ENCLOSURE (4)



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OBLIQUE AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 450 KTS., ALTITUDE - 125 FT., CYCLING RATE - 4 FRAMES/SEC., SHUTTER SPEED - 1/2400 SEC.
ENCLOSURE (5)



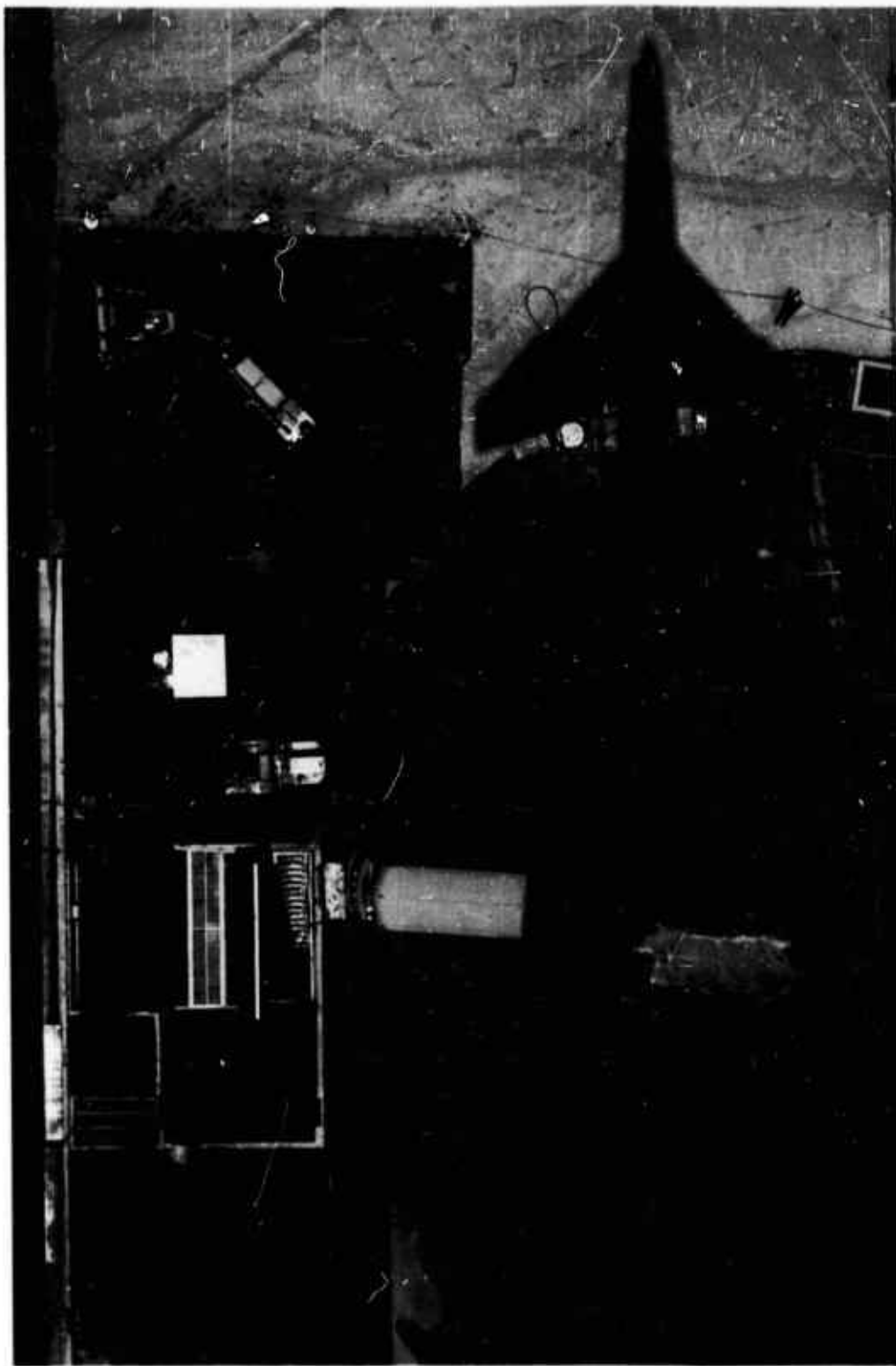
REPORT NO. NADC AP-6312

VERTICAL AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 450 KTS., ALTITUDE - 65 FT., CYCLING RATE - 9 FRAMES/SEC., SHUTTER SPEED - 1/5400 SEC.
ENCLOSURE (6)



REPORT NO. NADC AP-6312

VERTICAL AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 450 KTS., ALTITUDE - 200 FT., CYCLING RATE - 2.5 FRAMES/SEC., SHUTTER SPEED - 1/1500 SEC.
ENCLOSURE (7)



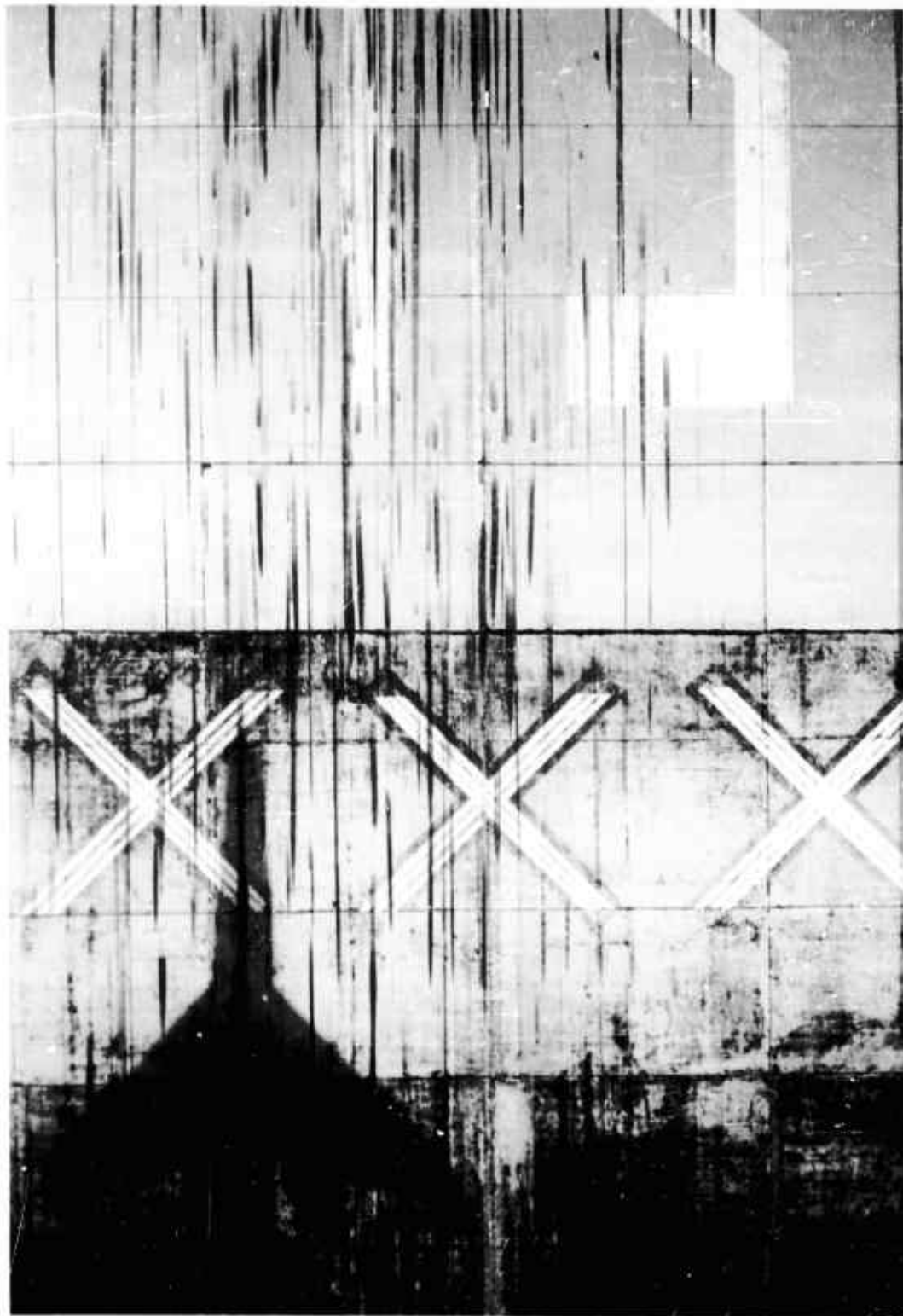
REPORT NO. NADC AP-6312

VERTICAL AERIAL PHOTOGRAPHY WITH THE TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 535 KTS., ALTITUDE - 140 FT., CYCLING RATE - 9 FRAMES/SEC., SHUTTER SPEED - 1/5400 SEC.
ENCLOSURE (8)



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VERTICAL AERIAL PHOTOGRAPHY WITH A TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 550 KTS., ALTITUDE - 600 FT., CYCLING RATE - 1.5 FRAMES/SEC., SHUTTER SPEED - 1/900 SEC.
ENCLOSURE (9)



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VERTICAL AERIAL PHOTOGRAPHY WITH TA-7 DELFT CAMERA SYSTEM. (4X ENLARGEMENT)
SPEED - 640 KTS., ALTITUDE - 100 FT., CYCLING RATE - 15 FRAMES/SEC., SHUTTER SPEED - 1/9000 SEC.
ENCLOSURE (10)

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U.S. Naval Air Development Center, Johnsville, Pa.
Aeronautical Photographic Experimental Laboratory
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BY ALBUQUERQUE DELFT CORPORATION
PHASE REPORT
Report UNCLASSIFIED
31 Dec 1963, 15p

1. REPORT NO. NADC-AP-4312
11. REPTASE FFD00001/202
2/7001 04 02
111. Amendment No 16

The APCL conducted a flight test program with the TA-7M camera manufactured by the Old Delft Co. of Netherlands. The flight test program was conducted over an altitude range of 65 to 600 ft and aircraft speeds which varied from 350 to 600 knots. The TA-7M camera was found to be a very specialized camera, well suited to very low altitude and high speed operation only.

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The APCL conducted a flight test program with the TA-76 camera manufactured by the Old Delft Co. of Netherlands. The flight test program was conducted over an altitude range of 65 to 690 ft and aircraft speeds which varied from 250 to 600 knots. The TA-76 camera was found to be a very specialized camera, well suited to very low altitude and high speed operation only.

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